MEETING XV BEVATRON RESEARCH CONFERENCE
April 6, 1954
4 PM Auditorium, Bldg. 50

E. J. Lofgren: Bevatron Status

On April 1, a new energy peak of 6.1 Bev was attained with the Bevatron. Scattered particles monitored with a counter telescope in triple coincidence gave approximately 100 counts per beam pulse.

April 2, the machine was down to air to allow work on beam monitoring equipment. Test operations resumed April 5. Though the total number of accelerated particles is still small, due to low energy beam losses, some cloud chamber tracks have been observed.

Several plates have been exposed for Goldhaber. Stars with up to 29 prongs have been observed.

G. K. Green: Cosmotron Operation

GENERAL

The following consists of a discussion of the administration, operation and some of the experimental techniques evolved in the use of the Cosmotron.

ADMINISTRATION

At the beginning of the experimental program, which was approximately one year after Cosmotron startup, the machine was utilized on a 4:1 basis. Four weeks of experimentation were followed by one week of maintenance. At the present time the machine behaves sufficiently well so that a 6:1 basis is in effect, with two shifts. In the near future it may be necessary to extend operations into the weekend to accommodate experimentalists.

PRESENT STATUS

A. Vacuum Chamber - The Cosmotron has been down to air since March 23 due to a puncture in the myvaseal blanket in quadrant 4. This failure is believed to be due to atmospheric oxygen and was aggravated by periodic stressing from cycling to atmospheric pressure. Pumpdown cycling has been minimized by isolating the experimental tangent tank with flip valves. Using this system, operation has continued for as many as four months without letting the entire machine down to air. Future plans call for isolation of another tangent tank to permit greater utilization of the available experimental area.

B. Shielding - When operating at maximum beam, the radiation level in the control room was above tolerance. The addition of a 3-foot thick concrete roof and wall over the tangent tank in the target area was found to be adequate.

The concrete shielding is separated on the median plane by 6-inch bricks. These bricks are removed and/or orientated as desired to provide good beam collimation.

C. Reliability - On the average, the Cosmotron has operated satisfactorily approximately 70 percent of the scheduled time.

On a day-to-day basis, the average beam intensity fluctuates by a factor of four with large deviations being improbable. Once stabilized, the variation of beam intensity from pulse to pulse does not vary more than 20 percent for a period of several hours.

D. Beam Intensity - Approximately 5 percent of the 2 ma of injected beam is trapped in synchrotron orbits.

Roughly 15 percent of this trapped beam remains at the end of the accelerating cycle. The large loss in trapped beam is known to be due to poor phase stability in the first 150 milliseconds of acceleration. A new radio frequency system is being built which is expected to increase the beam from 10^{10} to 10^{11} particles per pulse. At the end of the accelerating cycle, the elliptical beam is about 1 x 2 inches and 90° long.

E. Ejected Beam - Due to poor phase stability a large part of the beam is lost to the inner tank wall during initial acceleration. A clipper electrode protrudes 1 inch radially into the aperture in the inflector tank. This localizes the spill-out to one area so as not in interfere with cloud chamber work. Ram targets of 6 and 12-inch stroke are fired from the inner radius just before beam ejection.

If the target is near the equilibrium orbit just before the RF is turned off, the betatron and phase oscillation structure is found in the beam. If several milliseconds elapse before the magnetic field pulls the circulating beam in, the RF structure is missing.

The beam can be driven into the target with the RF tracking or by allowing the RF amplitude to decay exponentially. In the latter case, beam pulses up to 40 milliseconds in length can be obtained.

EXPERIMENTAL TECHNIQUES

A. Magnets - Sorting magnets have been found to be necessary in all experimental work. Selection of positive and rejection of negative and neutral beams is required to keep the background down. Five magnets now exist and two more are to be ordered. The most versatile magnets which turn out to be just marginal for this energy are 4 x 18 x 36 and 6 x 18 x 36 with 15 and 16 Kg fields.

B. Cloud Chambers - The beam intensity at injection is reduced for cloud chamber work by a quadrupole magnet. This technique defocuses most of the off axis particles and has proved to be the most satisfactory of several methods tried.

Cloud chambers are preceded by a sorting magnet which enables selection of charged beams or with chamber motion selection of neutral beams and rejection of charged beams. A flux of approximately 5000 π^- particles can be placed within the 12-inch diffusion chamber. A maximum of 25 to 50 particles per pulse is desired. Several cloud chambers are used simultaneously by programming the operation of ram targets in two tangent tanks at periods comparable with those of diffusion and expansion chambers.

C. Counting Experiments - Holes are provided in the shielding for 23°, 56°, and 90° upstream and downstream monitoring. Counting telescopes are operated in quadruple coincidence with counters 20 feet apart. A magnet is interposed between the second and third counters to deflect the desired beam. Approximately 50 percent of the π^- beam is usable. The remaining 50 percent contains degraded particles which can be separated by magnets and time of flight techniques. Some focusing of the beam results from its transit through part of the magnet sector on ejection. At peak intensities the counting rate over a 3 square inch area is of the order of 50 counts per pulse.

A 3-foot quadrupole magnet with a 12-inch aperture is being ordered. This magnet should increase the π^- counting rate a factor of 40 and may enable differential experiments to start.

D. Targets - Most of the targets used thus far have been of the lip type. A 1/8 by 1/4 protruding edge on the target has proved to be a very satisfactory method of turning the beam into the main target. Radio chemistry measurements show that most of the beam strikes the first 1/4 to 1/2 inch of the main target.

PROTON BEAM EJECTION

A multiple lip target is to be used in conjunction with a pulsed (and possibly rammed) C-magnet to eject the main beam in 1 1/4 turns. Tests on this target have shown that 20 percent of the beam is transmitted through the 1 square inch exit hole.

POLE FACE WINDING EXCITATION

The excitation of the pole face windings raised the peak energy of the machine from 2.3 to 2.97 Bev. The adjustment of these windings proved non-critical.

Summaries. Harry Heard
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